Sertifikaat

REPUBLIEK VAN SUID AFRIKA

PATENT KANTOOR
DEPARTEMENT VAN HANDEL
EN NYWERHEID

Certificate

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE
DEPARTMENT OF TRADE AND
INDUSTRY

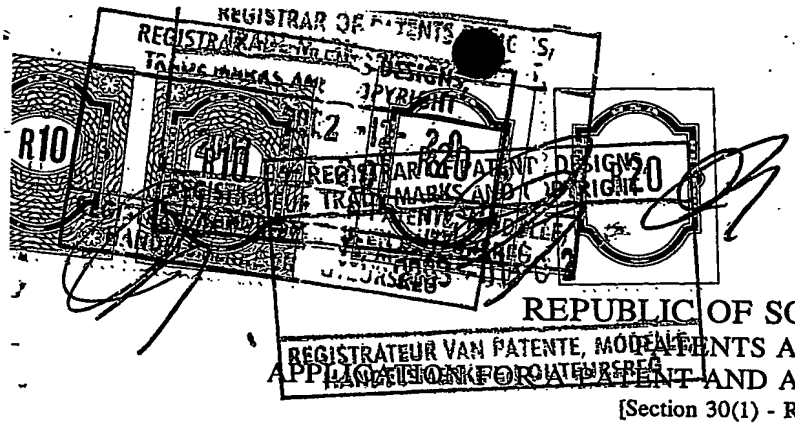
Hiermee word gesertifiseer dat
This is to certify that

the annexed documents are a true copies of the provisional specification and drawings of South African Patent Application No. 2002/10332 filed on the 20 December 2002.

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

in die Republiek van Suid-Afrika, nierdie 13th dag van April 2004
in the Republic of South Africa, this day of

Registrar of Patents



Galgut & Galgut

Johannesburg
South Africa

Form P 1

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978
APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT
[Section 30(1) - Regulation 22]

Official Application No		Applicants Ref
21	2002/10332	84317

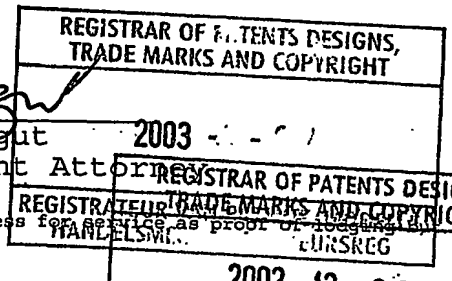
71		Full names of Applicant
Hilliary Carmen PEARMAN		
		Address of Applicant
21 Chaucer Avenue, Senderwood, Bedfordview		
54		Title of invention
Vehicles		

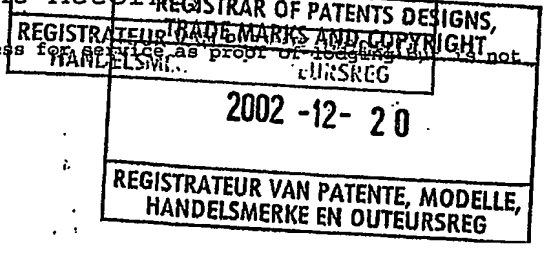
The application is accompanied by :-

✓	1.	A copy of a Provisional Specification of 16 pages.
✓	2.	Informal Drawings of 9 sheets
	3.	Publication Particulars and abstract
	4.	A copy of Figure of the drawings for abstract
	5.	Assignment of invention
	6.	Certified priority documents
	7.	Translation of priority documents
	8.	An assignment of priority rights
	9.	A copy of Form P2 and the specification of S A Patent Application No 21. 01.
✓	10	A declaration and power of attorney on Form P3
	11	Request for ante-dating on Form P 4
	12	Request for classification on Form P9
✓	13	Form P2
		Address for Service Galgut & Galgut Johannesburg

Dated this 20 December 2002

John Galgut
Applicant's Patent Attorney





The duplicate will be returned to the applicant's address for service as proof of lodging but is not valid unless endorsed with official stamp

Galgut & Galgut

Johannesburg
South Africa

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978
PROVISIONAL SPECIFICATION
[Section 30(1) - Regulation 27]

Official Application No	
21	2002/10332

Lodging Date	
22	2002 -12- 20

Full names of Applicant(s)	
71	Hilliary Carmen PEARMAN

Full name(s) of inventor(s)	
72	Kevin Patrick Austin PEARMAN

Title of invention	
54	Vehicles

This invention relates to vehicles.

For various reasons the conditions of the wheels or tyres of vehicles become unacceptable. The most typical of these conditions occur when the air pressure in a tyre falls below a predetermined amount. Another unacceptable condition is when the wheel becomes overheated due for example to brakes jamming. A further unacceptable condition occurs when there is excessive vibration of the wheels.

When tyres on vehicles and in particular on loaded trucks are under inflated or flat this causes serious problems. In particular riding on a loaded truck on under inflated or flat tyres causes massive heat build up and distortion of the profile of the tyres. This destroys the side walls and carcases of under inflated or flat tyres.

When a "flat" occurs on a side-by-side configuration, the good tyre then bears the load of both the tyres causing excessive wear on the good tyre. If this condition persists the two tyres bulge and run against each other causing a tremendous heat build up in both tyres and the resultant destruction of both tyres. This is a costly event as of course is the down time of the vehicle.

Furthermore there is the serious problem of large chunks of tyres (often the tread of retreaded tyres) falling off, being either thrown by the tyre into the path of oncoming traffic or just lying in the path of traffic threatening damage to vehicles on the road. Such thrown off tyre chunks may also snag and damage the

brake lines resulting in brake failure. In addition the loss of parts of the tyre will cause unacceptable vibration of the wheel.

It will be appreciated that tyres and in particular tyres used on trucks and lorries are extremely expensive items. Thus the destruction of a tyre has serious economic consequences. In addition if one or more tyres are deflated this will cause increased drag on the lorry which will result in increased fuel consumption and consequent increased cost in the running of the truck or lorry.

It follows that it is highly desirable to provide a wheel condition detection and signalling device (WCDSD) which will give a warning when there is an unacceptable condition of a wheel. Numerous deflation detectors (which are one type of WCDSD) have been proposed to provide the driver of a vehicle with a warning that one or more tyres are under inflated. Many of these detectors are required to transmit a signal on detection of under inflation to a receiver in the cab of a truck so that the driver is aware of the position. A significant requirement of such detectors is the provision of electrical power to power the detectors and transmitters. Clearly batteries which have a finite life are not entirely satisfactory.

A number of tyre deflation detectors have been proposed incorporating means for powering the transmitter. In particular there is known a WCDSD of the kind comprising

a chamber which is capable of being attached to the wheels of a truck to rotate therewith and

a "pendulum" having significant mass and being rotatably mounted within the chamber,

the arrangement of the pendulum within the chamber being such that the pendulum remains generally non-rotating during rotation of the chamber, the chamber and the pendulum carrying respectively magnetic poles and wire coils so that on relative rotation of the coils and the poles, an electric current is generated in the coils,

the WCDSD further comprising

detector means for detecting an unacceptable condition of the wheel and emitting a signal dependant upon such condition and

a transmitter for transmitting that signal to a receiver.

Such a detection device is hereinafter referred to as a "detection device of the kind set forth".

Many detection devices of the kind set forth have been proposed. On the face of it these are usually theoretically capable of working. However I have found that such devices are in most cases not sufficiently robust to withstand the various forces that are incurred at the axle of a truck and consequently the detectors fail. Alternatively the cost of manufacturing the detector become prohibitive. Furthermore I have found that the power generated at the generator described above is often, if not usually, less than the requisite power for operating the transmitter to transmit the signal to the receiver.

Typical of arrangements above described are to be found in my South African Patent No 97/6722 (corresponding to US Patent NO 6,046,672); US Patents 4,229,728 1997 (Tremba); 4,075,603 (Snyder); and 4,536,668 (Boyer) and European Patent 0 563 723 (Eurafrica Videomatic S.r.l.).

I have attempted to overcome this problem in a new arrangement which embodies the invention.

According to one aspect of the invention there is provided a device of the kind set forth wherein the stator comprises a coil mounted on a "C"-shaped core having two end faces and the pendulum carries a series of magnets of opposite polarity, the arrangement being such that on relative rotation of the stator and the pendulum, the magnets will pass the end faces of the coil in adjacent relationship, and that when one magnet is adjacent one end face of the coil, another magnet of opposite polarity is adjacent the other end face of the coil. The magnets are preferably arranged in a circle on the pendulum centred on its axis of rotation and having a diameter approximately equal to the distance apart of the centres of the end faces of the coil.

There are preferably a "double odd number" (as defined below) of the magnets. By the term "double odd number" as used herein is meant an even number which when divided by two gives an odd number in excess of one. The preferred number of magnets is six. The magnets are preferably arranged with their polar axes parallel to the axis about which the pendulum swings.

The pendulum conveniently comprises an annular part rotatably carried by a bearing and an eccentric weight projecting therefrom. The annular part carries the magnets on one face thereof. The eccentric weight preferably comprises lead or other heavy material and has a mass of between 200 gm and 500 gm and preferably between 320 gm and 360 gm and more preferably about 340 g. The weight is preferably bolted on to a member projecting from the annular part. The

member preferably further comprises a substantially cylindrical part within which the bearing is received.

This part preferably has inwardly directed means at its mouth or open end. The part is capable of being resiliently distorted to permit the bearing to enter the said part, the arrangement being such that when the part returns from the distorted position, the inwardly directed means extends into the path of the bearing to prevent or inhibit it from being removed from the said part. The cylindrical part is preferably provided with a plurality of pairs of closely spaced cuts or slots that define between them arms which can resiliently swing outwardly. The inwardly directed means are provided at the ends of the said arms. Reinforcing gussets preferably in between the cylindrical member and the annular member.

Where the unacceptable condition is a low tyre pressure, a pressure detection means is preferably incorporated in a chamber which is capable of being connected to a tyre to be subject to the pressure therein. A pressure detector is preferably provided within the chamber and is connected to the electrical means. The pressure detector is preferably mounted on the board, preferably a PCB, on which the electrical means is carried. A heat conductor is also preferably provided having a part projecting into contact with the part of the wheel and another part in direct or indirect communication with a heat detector connected to the electrical means. In addition the device preferably further comprises a vibration detector. The vibration detector conveniently comprises a cylinder with a movable clapper therein.

The device preferably carries a battery to power the transmitter when the tyre is not rotating. This battery is preferably a re-chargeable battery so that when the tyre is rotating it can be recharged.

Additional or other detector means may be provided. The device may be used on the wheels of a truck and also the wheels of a railway carriage.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings.

In the drawings: --

Figure 1 is a perspective view showing the a wheel condition detection and signalling device of the invention in place on the a wheel pair of a truck.

Figure 2 is a section on line 2 - 2 of Figure 1,

Figure 3 is a section along the diameter of the device,

Figure 4 is a perspective view of the outer side of the device,

Figure 5 is a perspective view of the inner side of the device,

Figure 6 is a perspective view of the pendulum arrangement,

Figure 7 is a perspective view of the pendulum,

Figure 8 is a section through the pendulum,

Figure 9 is a perspective view of the counterweight,

Figure 10 is a section on line 10 - 10 of Figure 9,

Figure 11 is a perspective view of the heat guide,

Figure 12 is a section through a bearing pin on which the pendulum is rotatably mounted,

Figure 13 is a perspective view of the bracket,

Figure 14 is a section through the device showing the heat guide,
Figure 15 is a perspective view of the vibration device.

Referring now to Figure 1 there is shown a wheel condition detection and signalling device (WCDSD) 10 of the invention. The WCDSD 10 is mounted on each wheel drum of a truck (including the "horse"). Some (and indeed most) of the wheel drums carry a pair of wheels and tyres. The WCDSD 10 is capable of working with such an arrangement as well as where the wheel drum carries a single wheel and tyre.

This WCDSD 10 comprises a control casing 100 mounted on a bracket 200 carried by a wheel 300 of a truck.

The bracket 200 is a sheet steel pressing comprising a central land 202 carried by six legs 204 having outwardly directed feet 206 at their ends. Each foot 206 has an opening 208 therethrough. These feet 206 rest on the flange 302 of the dust cap 304 of the wheel 300. Stub bolts 306 which secure the dust cap 304 to the wheel 300 each alternate bolt 306 passes through the openings 208 of the feet 206. Nuts 308 engaging the bolts 306 secure the bracket 200 to the wheel 300.

A number of openings 210, 212 and 214 are formed in the land 202. These openings will be described more fully below as will be the way in which they are used.

The control casing 100 comprises an upper and a lower part 102 and 104 respectively which are plastics mouldings preferably comprising Nylon 6/6 with a 30% glass fibre filling. The parts 102 and 104 define an internal chamber. This chamber is divided by a divider plate 106 into an upper chamber portion 108 and a lower chamber portion 110.

Externally the upper part 102 has a pair of upstanding hollow bosses 112 and 114 near the periphery of the part 102 at diametrically opposed locations. The lower part 104 is provided with similar but lower hollow bosses 116 and 118 which register with the bosses 112 and 114. The base 120 of each boss has a central aperture 122 but otherwise seals off the internal chamber. The bosses have internal tubular extensions 124 within the chamber extending to and clamping the divider plate 106 in position. Each extension 124 defines an inner space 126 below the base 120. Within each space 126 there is a hollow pressure housing 128 having a projecting flange 130 which rests on the divider plate 106. A similar pressure housing number 132 with a similar flange 134 is provided on the opposite side of the divider plate 106. Bolts 136 pass through the flanges 130 and 134 as well as the divider plate 106 to seal the parts together. O-rings 138 and 140 seal the upper and lower ends of the housing members respectively to the bases 120 of the bosses and the divider plate 106. A number of small openings (not shown) are provided through the divider plate 106 so that the interiors of the two housings are in pneumatic communication.

Fitted in sealing manner into the aperture 122 in the base 120 of each boss is a pneumatic valve 144. Contained within the interior of each of the lower pressure housings 132 is a pressure gauge 146.

The divider plate 106 is a printed circuit board (PCB). The PCB carries inter alia a microprocessor, a transmitter and receiver. The electronic parts carried by the PCB are mainly on the upper side of the divider plate 106 in the upper chamber 108. The pressure gauge 146 is connected directly to the electrical connections on the PCB 106.

A narrow boss 148 extends from close to the centre of the upper part 102 to the divider plate 106 and is connected thereto by a screw (not shown).

Provided on the underside of the divider plate 106 are a number of equi-spaced internally threaded bosses 152. The bosses 152 are located close to the periphery of the plate 106. A coil assembly 154 is centrally located on the underside of the plate 106. The assembly 154 comprises two coils 156 wound on a plastic mounting having four legs 158 which are secured to the plate 106. The coils 156 are respectively fitted on to the arms of a C-shaped laminated core 162. The coils 156 are connected to the PCB to power the latter.

The lower part 104 has a deep dished central portion 164 having a base 166. Openings 168 having hexagonal countersunk mouths are provided on the base 166. Screws 170 pass through the openings 214 in the land 202 of the bracket 200 and the openings 168 where they engage in nuts 173 in the mouths of the openings to secure the control casing 100 to the bracket 200.

Within the central portion 164 is a pendulum arrangement 400 (see also Figures 6 and 7). This arrangement 400 includes a moulded plastic pendulum 402 having a generally circular body 404 on a flange 406 and having radial gussets 408

extending between the body 404 and the flange 406. On the underside of the flange 406 there are six reinforced recesses 410 in which are respectively received low cylindrical magnets 412. The magnet ends projecting beyond the recesses 410 are of alternating polarity.

The flange 406 has an arcuate projection 414 subtending 80° degrees at the centres of the pendulum 402. There are three equi-spaced apertured bosses 416 on the projection 414. The bosses 416 have bores therethrough, the upper openings 420 of which are hexagonal in shape.

A heavy, lead, counterweight 422 (best shown in Figures 9 and 10) having a mass of approximately 310 grams, is provided for the pendulum 402. The counterweight 422 is generally in the shape of a portion of the segment subtending 90° at the notional centres of the counterweight. The counterweight 422 is substantially "L" shaped in section having a main deep arcuate portion 424 with a radial inwardly directed leg 426. Large axially directed countersunk bores 428 are provided through the main potion 424. The main portion 424 rests against the lower face of the projection 414 of the pendulum. The heads of the countersunk bores 428 receive the bosses 416 respectively. A screw 430 passes through each bore 424 and the boss 416 and engages a nut 432 closely fitting into the hexagonally shaped upper openings 420.

The outer race of a ball bearing 434 is a press fit in the body 404 (as will be described more fully below) and rests on a raised lip 435 of the base of the pendulum (see Figure 8). A bearing pin 436 (see Figure 12) has a cylindrical shaft 438 which fits into the inner race of the ball bearing 434. A flange 440 of the

bearing pin 436 rests on the central land 202 of the bracket 200. It has a central projection 442 which passes through the central opening 210. Internally threaded blind bores 444 are provided on the underside of the flange 440. Screws passing through the openings 412 secure the bearing pin 436 to the land 202.

It will be seen therefore that as the wheels 300 and with them the WDCSD 10 rotates about a horizontal axis, the pendulum 402 carrying the heavy counterweight 422 will remain substantially stationary. Thus the ends of the coils 156 will pass by the magnets 412 which will induce and electrical current into the coils 156. Such electrical current will serve to provide power for the PCB and of the transmitter (to be described) carried thereby. It will be noted that when any magnet is opposite one arm of the coil, the magnet opposite the other coil would be of the opposite polarity.

The body 404 has six pairs of axial cuts 443 forming six clamping arms 444 (best shown in Figure 7). Each arm 444 is located between a pair of gussets 408. It has an inwardly directed nose 446. Thus, as the outer race of the bearing is forced into the body 404, the body 404 is distorted so that the arms 444 are swung outwardly to permit the race to pass the noses 446. After the race has homed in the body 404 the arms swing backwardly to their original position. The noses 446 are now located at the outside face of the outer race and hold the race against withdrawal. A security plate 448 is attached to the pendulum 402 after the insertion of the race. This plate 448 has a circular aperture (not shown) in which the upper end of the body 404 and the arms 444 are retained. The plate 448 prevents the arms 444 swinging outwardly to permit the race to escape. The

security plate 448 is secured to tall bosses 452 projecting axially from the pendulum 402.

A heat detector 171 is provided. It comprises a bent sheet metal heat guide 172 (see Figure 14) having a short leg 174 at one end and the wider slightly longer leg 176 at the other end. The short leg 174 extends through the base 166 of the dished part 164 and is bent to lie flat thereagainst. It is clamped by the base 166 against the land 202. The other leg 174 is screwed to a projection of the lower part close to the PCB 106. The leg 174 in the assembled unit rests against the base of a heat sink 178 secured to the PCB 106. The heat sink 178 is in contact with a heat sensor (not shown) on the PCB. The heat sensor in turn is connected to the microprocessor. Should the temperature of the wheel increase beyond a certain amount, the heat transferred by the heat guide 172 and to the heat sensor will increase beyond a predetermined amount. The microprocessor will recognise this as an unacceptable situation.

At the centre of the divider plate 106 in the upper chamber portion 108 there is a vibration detector 500 (see Figure 15). The vibration detector 500 comprises a metal cylinder 502 and a clapper 504. The cylinder 502 is secured to the divider plate 106 and connected to an appropriate electronic member (not shown). The clapper 504 has a heavy head 506. It is located centrally of the cylinder 502 and is capable of swinging when the wheel is subjected to vibration. The clapper 504 is connected to another electronic member. Should the wheel vibrate the clapper will swing and make contact with the cylinder 502. This will complete the circuit between the two electronic members which will convey this information to the microprocessor. Should the vibration be due to road

irregularities then the vibration will be arbitrary and will be recognised as such by the microprocessor. However if the tyre on the wheel should shed some tread, the vibration would be cyclical. This will be recognised by the microprocessor as an unacceptable condition.

A short copper or reinforced rubber pipe (not shown) having suitable connectors (not shown) at its ends connects in the valves to the valves of the two tyres. Thus the interiors 142 of the two housings are connected respectively to the tyres and are subject to the air pressure in the tyres. The pressure gages 146 within the interiors are therefore subject to the air pressure of the tyres which they are connected. The pressure gages 146 are connected to the microprocessor. Accordingly should the pressure in a tyre falls below a predetermined pressure, the microprocessor will recognise this as an unacceptable condition.

The microprocessor is arranged to activate the transmitter to send an appropriate signal when it, the microprocessor, detects an unacceptable condition as described above. A receiver (not shown) to receive such a signal is normally provided in the cabin of the truck. Thus the driver will be aware of any unacceptable condition the as soon as it arises.

We have found that the generator system comprising the coil and pendulum arrangement as described above produces enough power for the circuitry and the microprocessor and in particular the transmitter. However should the device be placed on the wheel of a multi trailer unit, the transmitter may not have a long enough range to transmit signals to the receiver in the cabin of the truck. To overcome this difficulty, each trailer unit may be provided with a wire connector

leading from a the rear of the unit to the front. At the rear of the unit there may be a receiver connected to the wire. A transmitter is connected to the front end of the wire. Thus the signal can be transmitted over a great distance to the receiver in the cabin.

I have found that the arrangement of the magnets on the pendulum and their arrangement relative to the faces of the coil provides a very satisfactory electrical generator which can generate adequate power for the transmitter even at relatively low rotational speeds of the wheels. I have also found that by having the pressure detectors within the pressurised chambers damage to the detectors that occurs in arrangements where a pipe is connected directly to the detectors is obviated.

The power generated as aforesaid may be put to additional purposes. For example, the number of revolutions which the tyre makes can be ascertained by counting the number of pulses generated by the magnets passing the ends of the coil. This number must the divided by the number of magnets to indicate a number of revolutions.

I further found that overall the arrangement as above described works extremely satisfactory in giving signals to the driver as to unacceptable conditions. Thus the driver is able to take remedial action quickly which prevents more serious conditions occurring.

In another example, a scanner system may be provided for determining the tyre wear. The scanner may be arranged to detect the length of the road over which the truck passes. The microprocessor will get calculate the number of

revolutions that the wheel completes when passing over this length of road. The microprocessor can thus determine the circumference of the tyre and hence the diameter of the tyre. After the tyre has worn the diameter of the tyre decreases and hence the wear of the tyre tread can thus be calculated by the microprocessor. Should the wear be too great this will be detected as an unacceptable condition and treated as mentioned above. In order that extraneous conditions do not affect this operation, it is preferably best effected when the truck commences its journey and is moving slowly.

The invention is not limited to the precise constructional details hereinbefore described and illustrated in the drawings. For example the device may be modified to detect unacceptable conditions on railway wheels. Here the unacceptable conditions would be excessive heat, excessive vibration and excessive wear of the periphery of the wheel. Railway units can be extremely long. Therefore the wire arrangement mentioned above (ie a wire extending along the length of each truck and having a receiver at the rear end and transmitter at the front end) may be essential for signals to reach a receiver in the driver's cabin in the engine.

Dated this 20 December 2002

Galgut & Galgut
Applicant's Patent Attorneys

3834

Fig 1

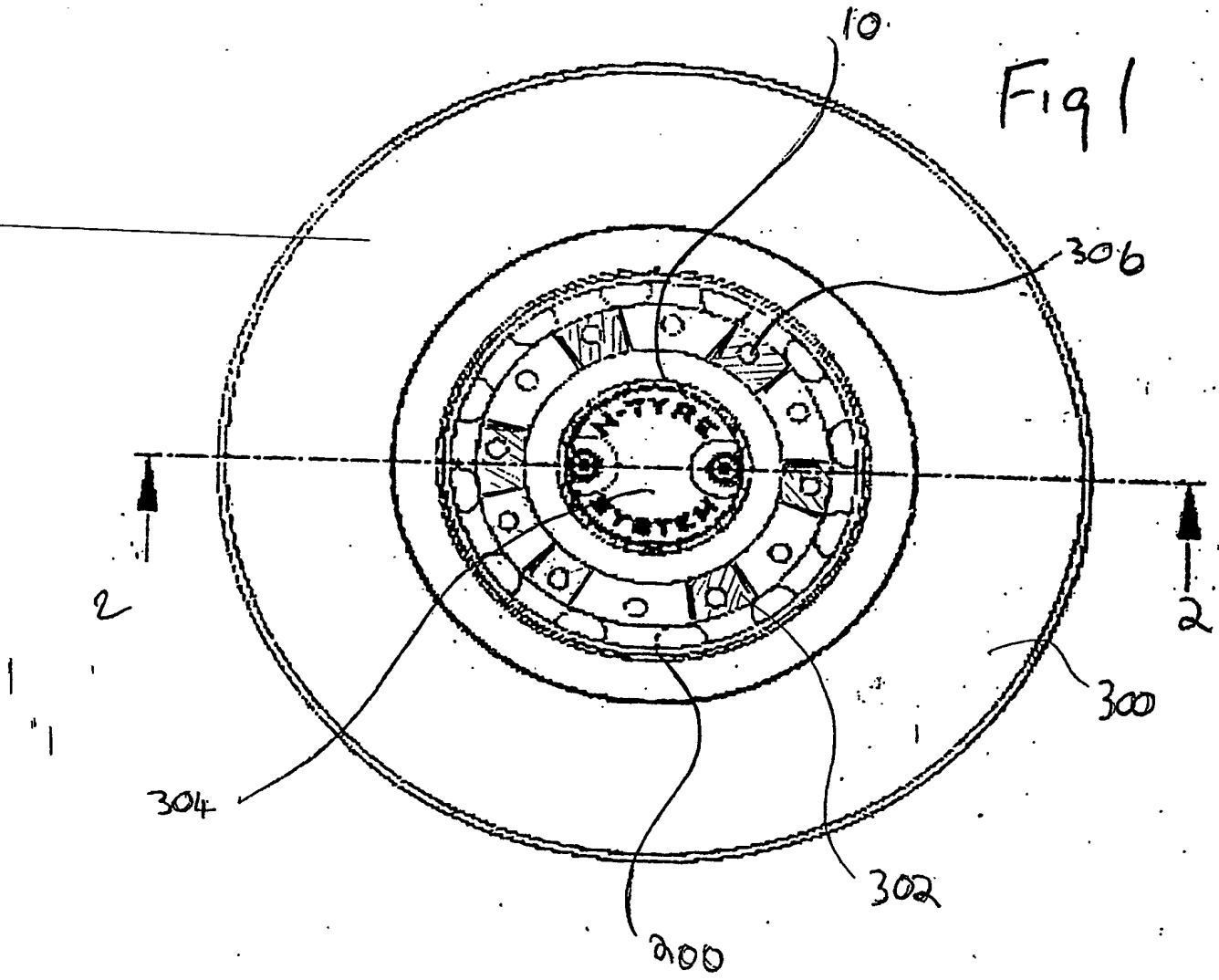


Fig2

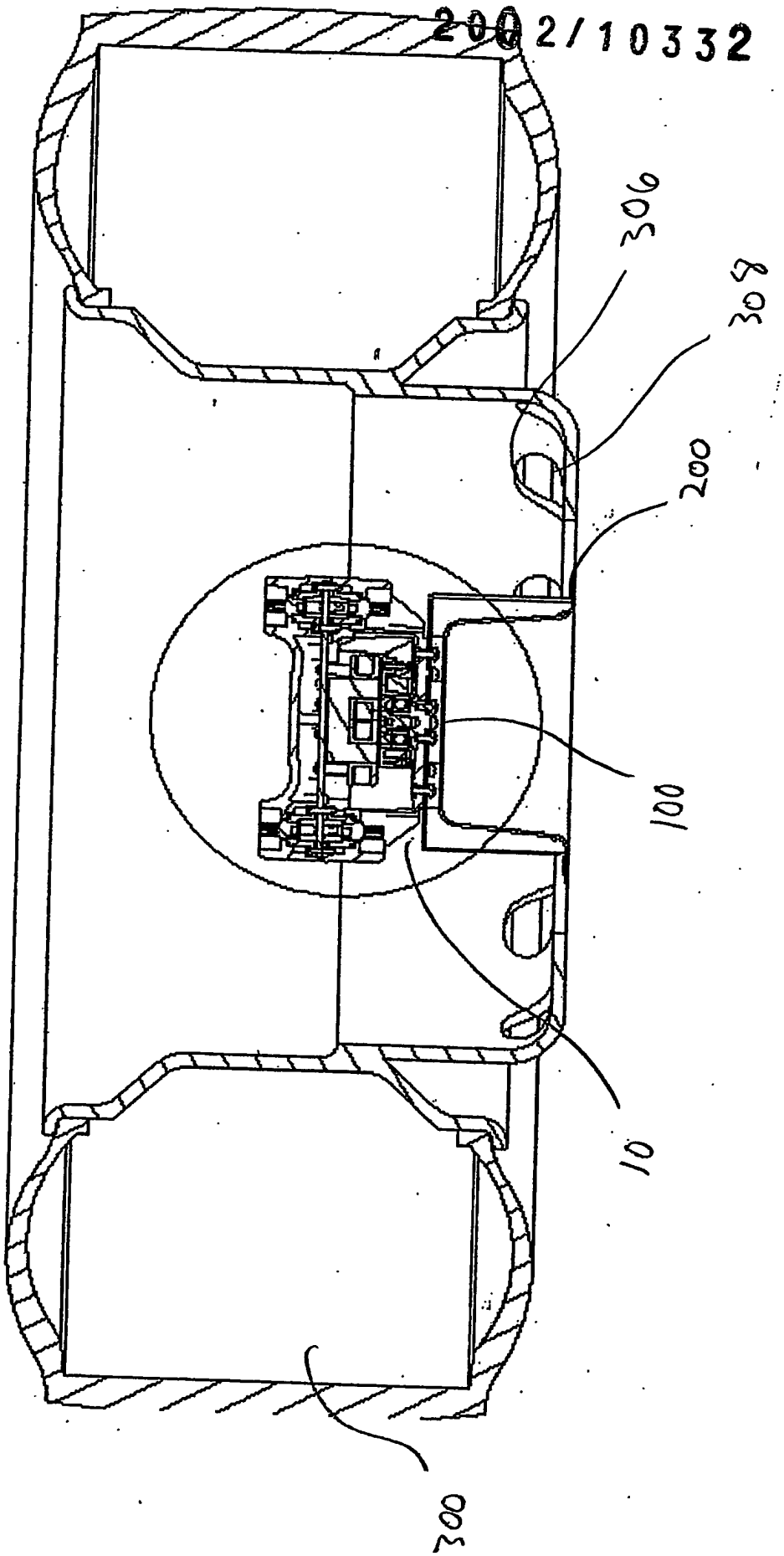


Fig 3

2002/10332

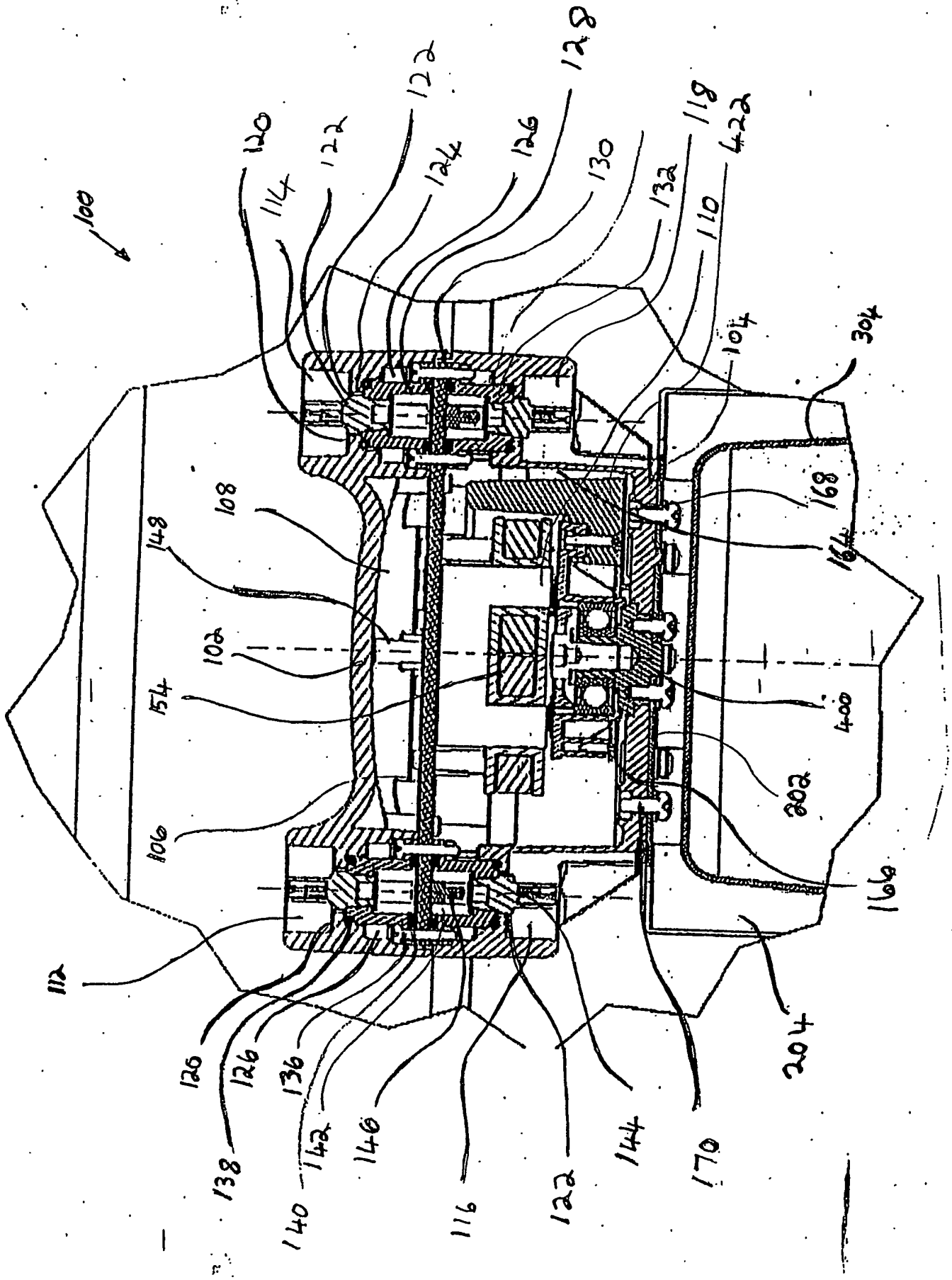


Fig 4

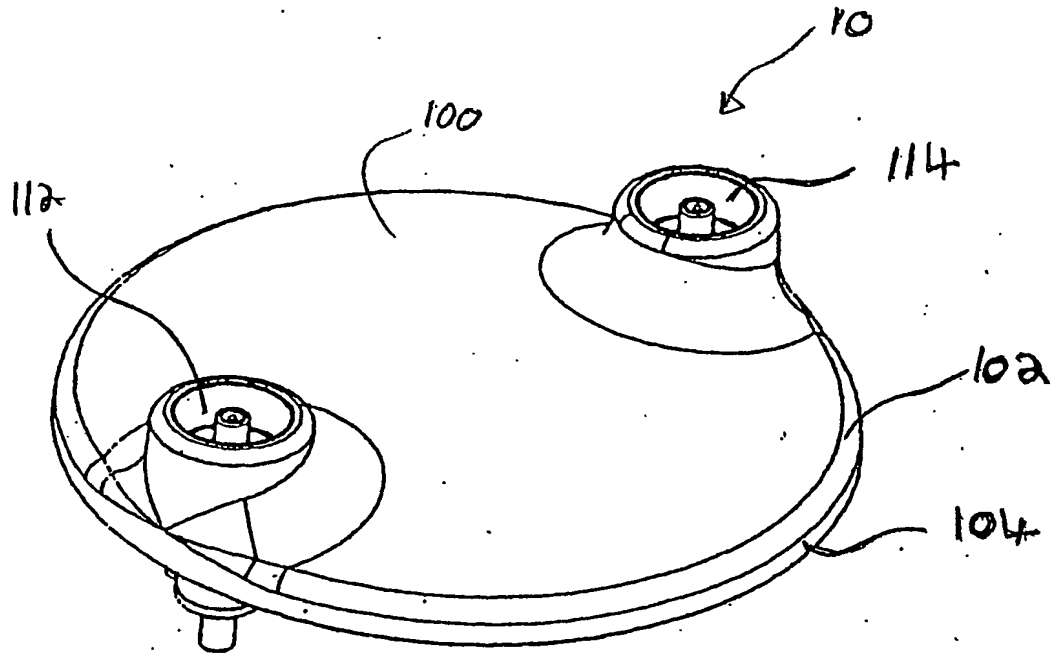

10
100
114
112
102
104

Fig 5

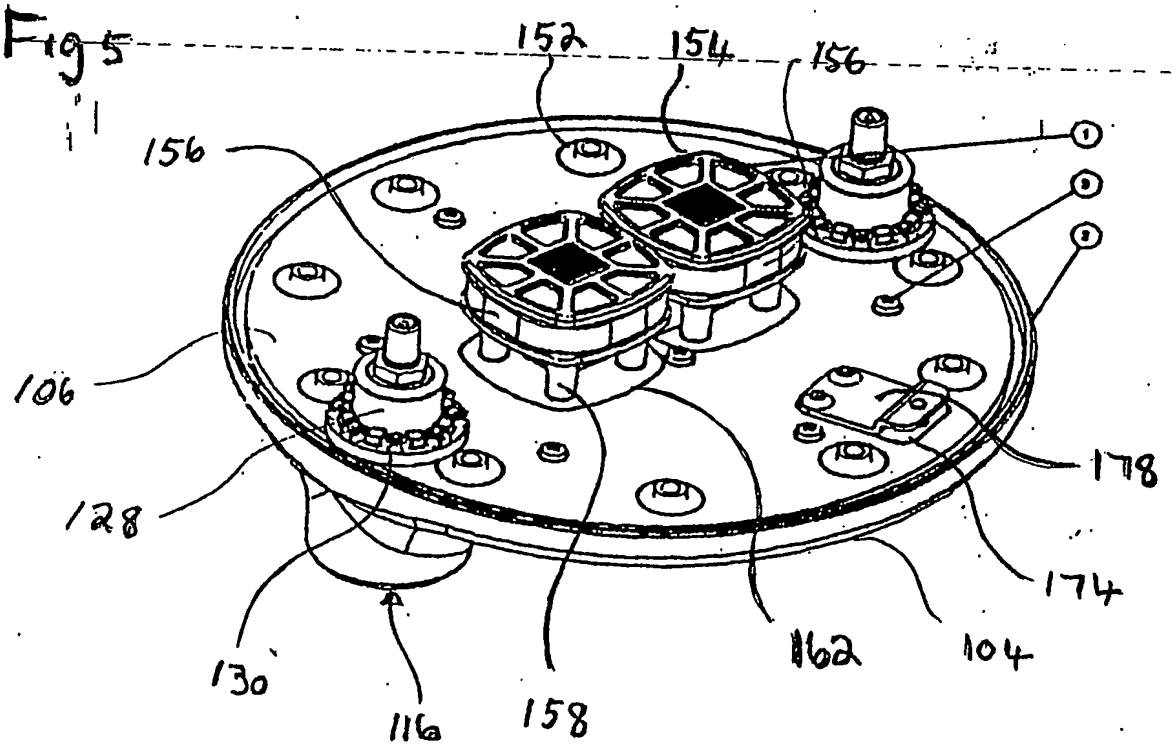

152
154
156
156
106
178
128
174
130
162
104
116
158

FIG 6

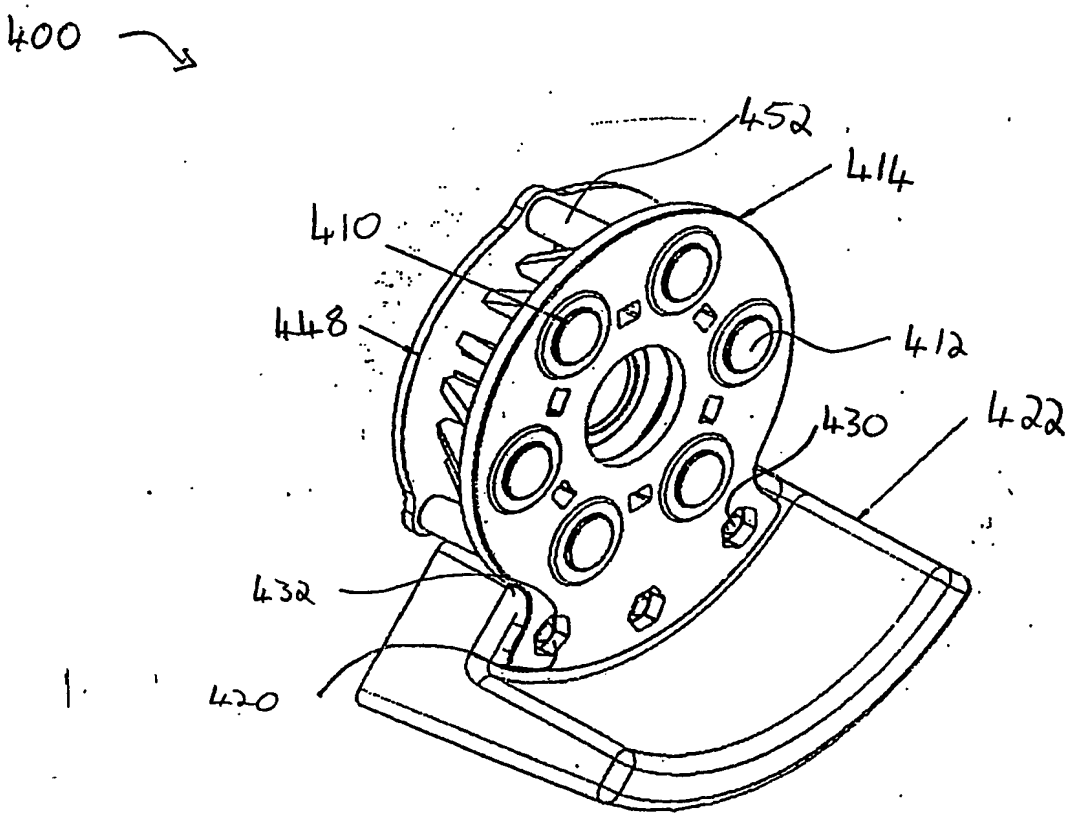
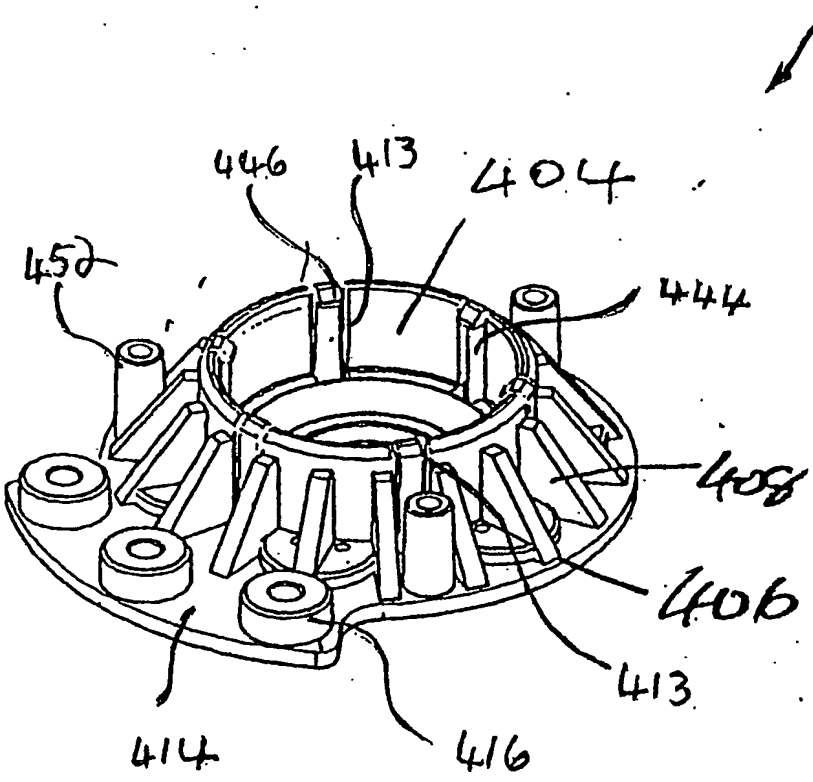


Fig 7


402
446
413
404
452
444
408
406
413
414
416

ig 8

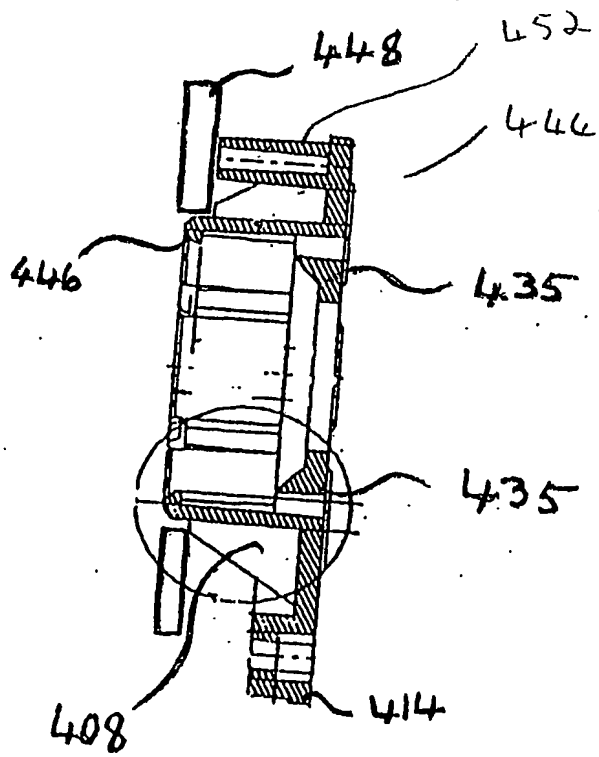

448
452
446
446
435
435
408
414

Fig 9

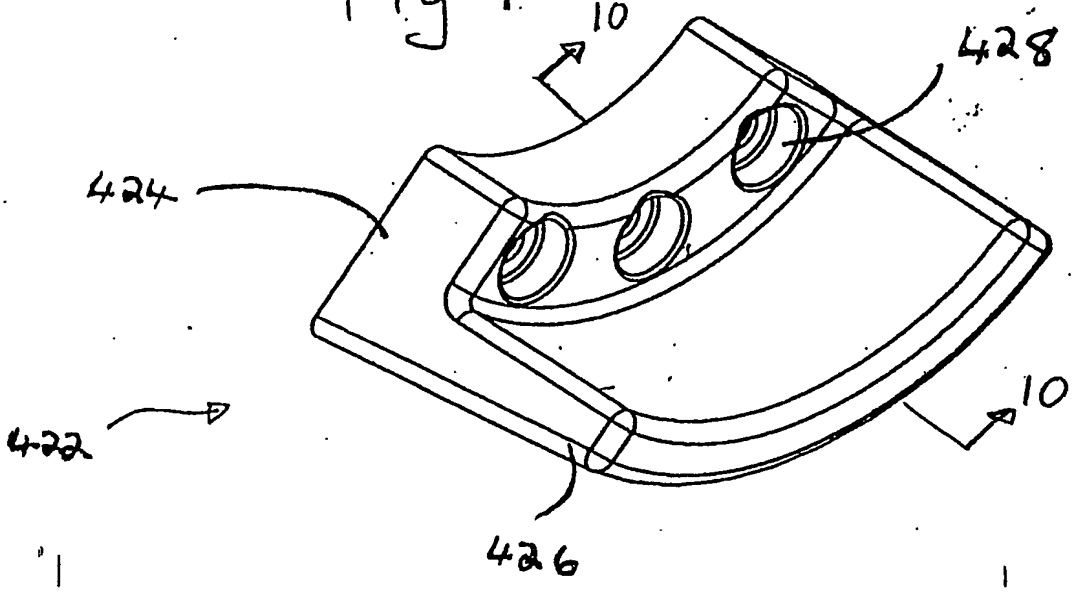


Fig 10

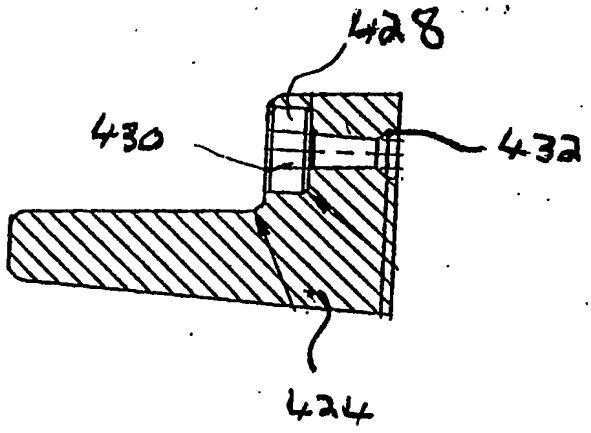


Fig 11

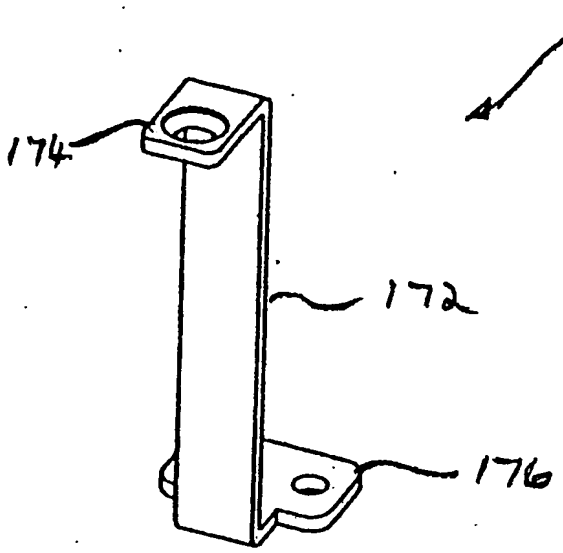


Fig 12

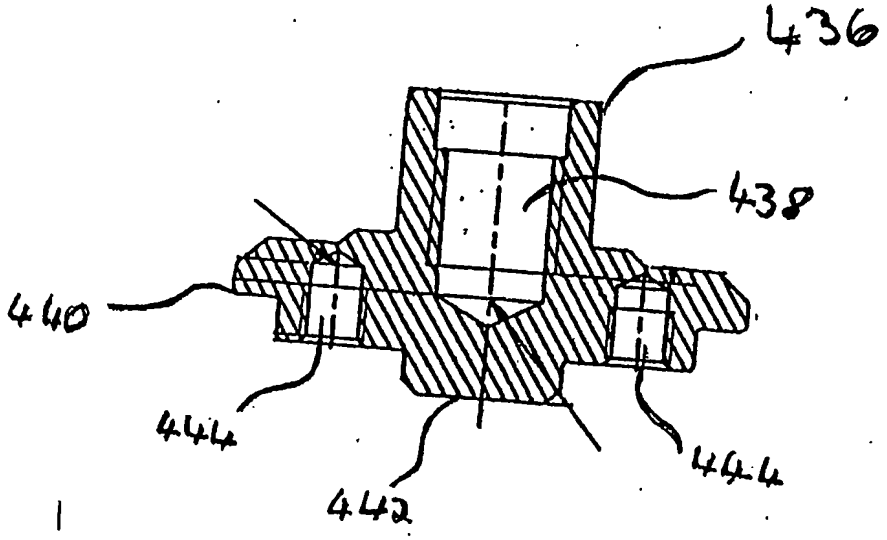
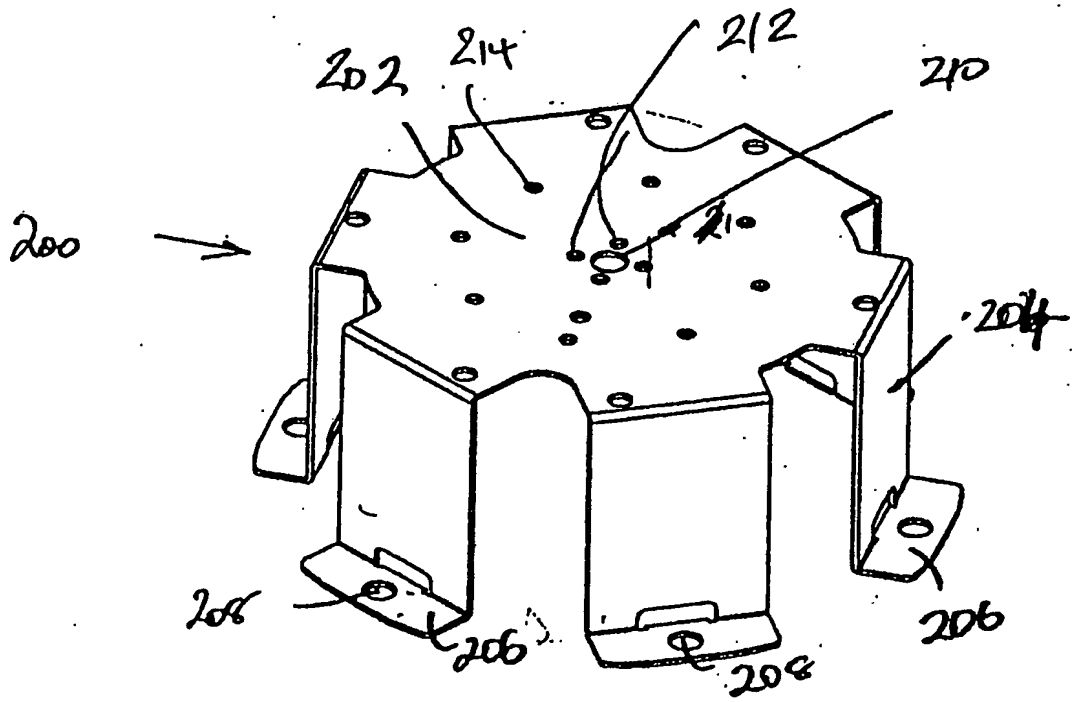


Fig 13



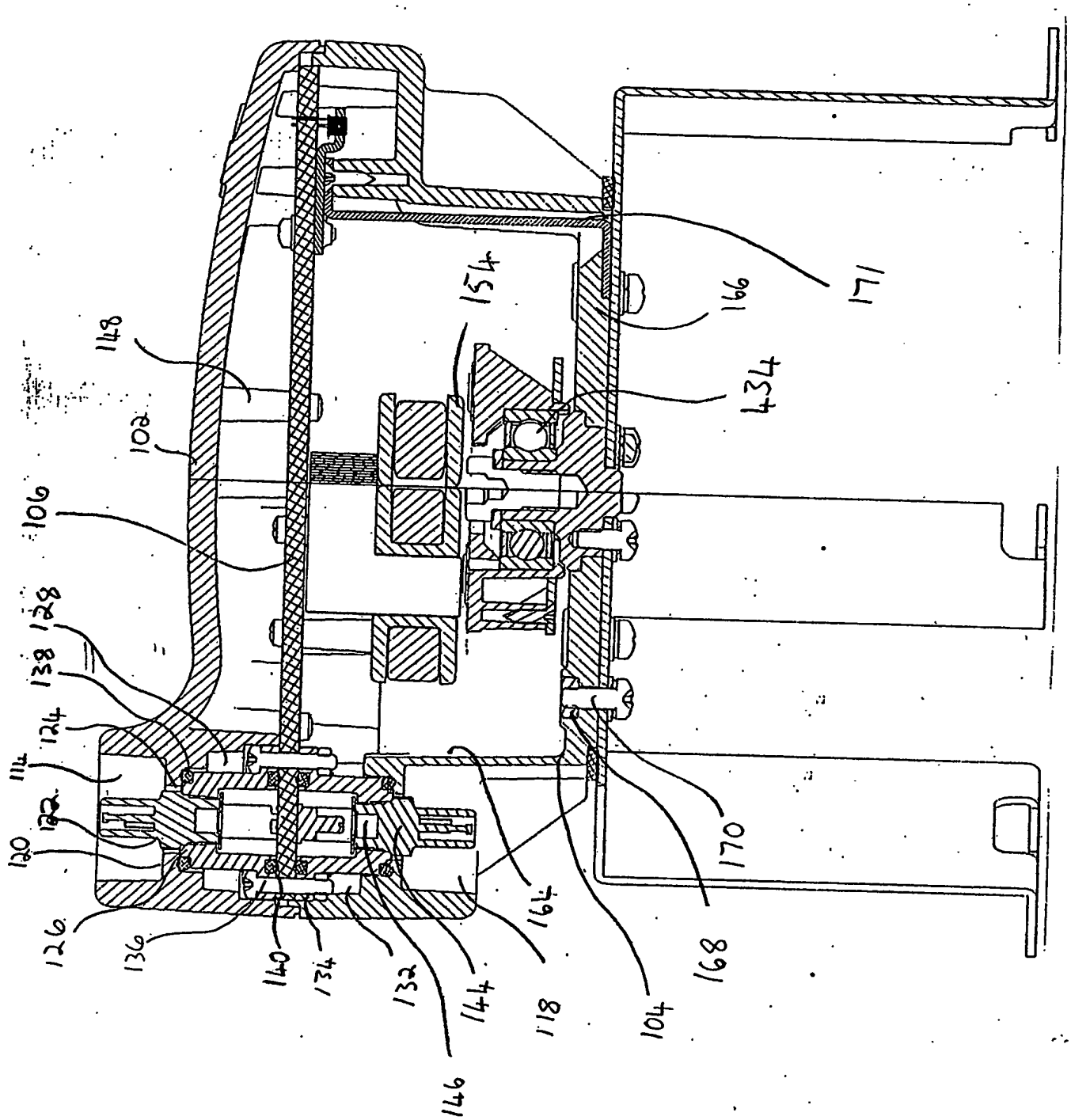
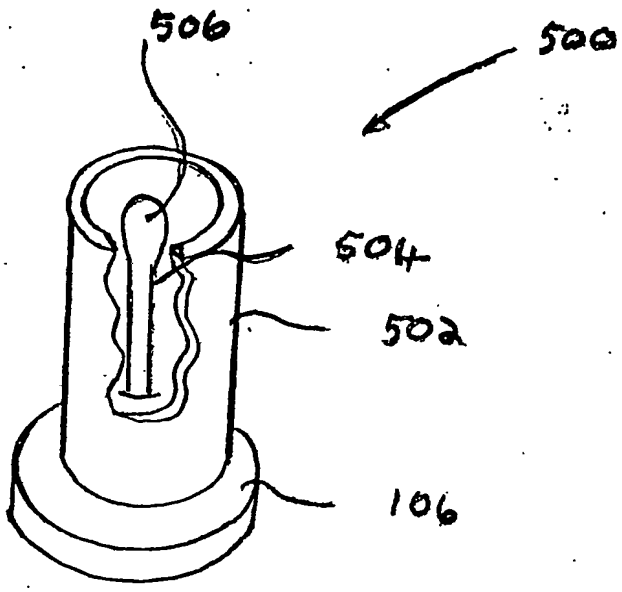

171
166
154
434
118
102
106
128
138
124
114
122
120
126
136
140
134
132
144
146
181
191
104
168
170

Fig 14

Fig 15



This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☑ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☑ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.